



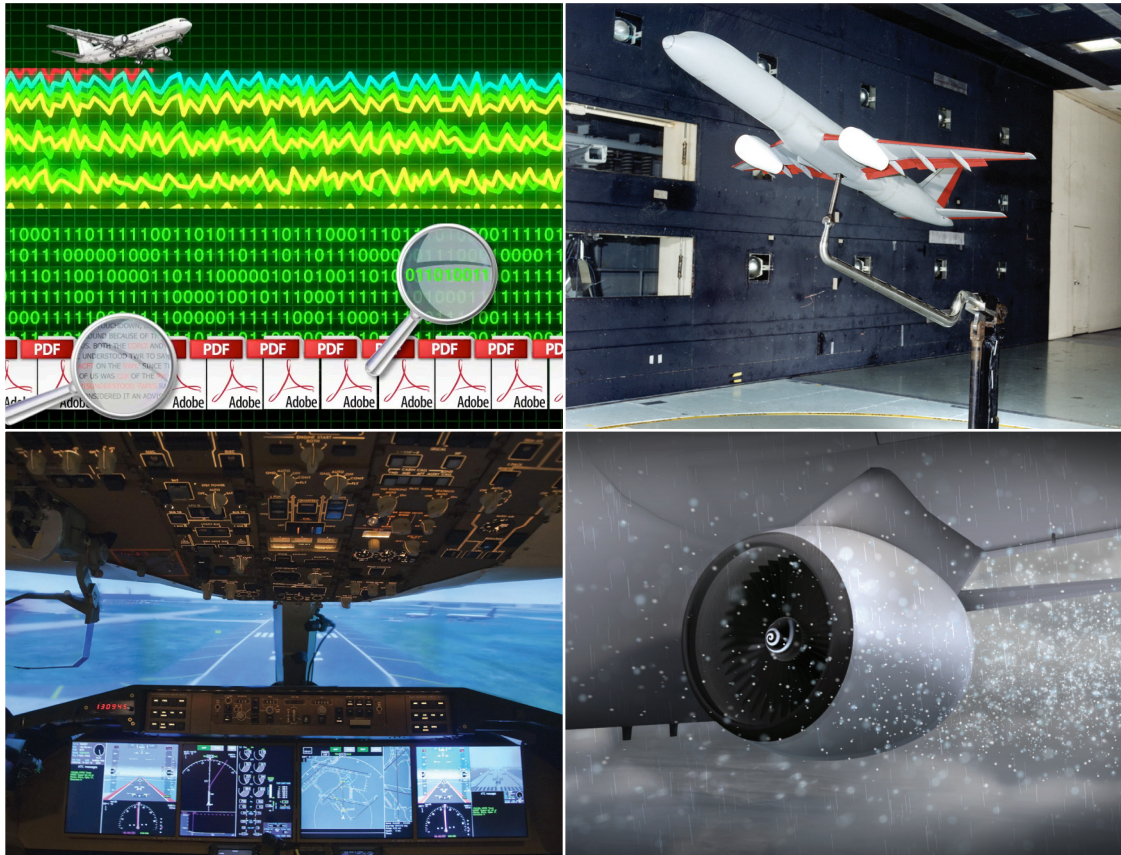
Aviation Safety Program

The Aviation Safety Program (AvSP), part of NASA's Aeronautics Research Mission Directorate, helps to develop new ways to achieve exceptional levels of safety for air travel despite increasingly crowded skies and congested airports.

Over the past decade, collaboration between industry and government to proactively identify new risks has led to historically low rates of commercial accidents. But as air traffic volume increases, the vigilance of the aviation community must continue. That's why, working with partners from academia and in the public and private sectors, AvSP conducts foundational research and develops new technologies to overcome the emerging challenges created by the nation's transition to the Next Generation Air Transportation System (NextGen).

To help provide solutions, the program investigates improvements to increase the inherent safety of aircraft systems and structures, ways to avoid atmospheric hazards, and development of next-generation concepts for on-board and on-ground safety systems. AvSP studies:

- Safety improvements associated with vehicle systems;
- Means of monitoring in-flight safety to reduce or eliminate any potential issues;
- Interactions between humans and automated systems to improve overall performance;
- Ways to accurately anticipate and prevent safety issues from ever occurring; and
- Methods to verify and validate complex, safety-related systems.



Images (Clockwise, from top-left) **Data Mining:** Computer-driven solutions that mine terabytes of aircraft flight data for clues to preventing safety issues are already proving useful to commercial airlines. **Flight Safety:** Subscale models are put through loss-of-control scenarios in NASA wind tunnels to test new recovery techniques. **Engine Icing Prevention:** Studies are being done into the types of atmospheric conditions that can form ice particles inside engines, leading to power loss. **Human-Friendly Flight Decks:** NASA uses flight simulators like this one where airline pilots test new cockpit technologies that could make airliners safer and more efficient.

NASAfacts

AvSP RESEARCH PROJECTS

Atmospheric Environment Safety Technologies Project

All aircraft must deal with the risks inherent to the atmospheric environment in which they operate. Although continuing technology development has greatly reduced overall concern, this project's goal is to investigate sources of risk and provide the technologies to help ensure safe flight despite any hazards that may remain.

A substantial portion of research within the project focuses on how icing affects both airframes and propulsion systems, and investigates potential technologies for ice detection and icing reduction or elimination. In collaboration with the broader icing research community, AvSP researchers study high-altitude, ice-crystal effects on airplane engines, which can cause damage to engine cores and power loss.

The project also studies the potential of electro-optic sensors that may be eventually deployed on future aircraft to assess atmospheric threats and provide guidance on how to avoid them altogether. In addition, research is being conducted on lightning strikes and their effects on composite materials used in a variety of aircraft structures.

System-Wide Safety and Assurance Technologies Project

This project is focused on methods to assess and ensure safety across the entire air transportation system. Among the most important elements investigated are:

- Managing the increasing complexity of and reliance on automation;
- Providing ways to better analyze and disseminate safety data;
- Supporting enhanced levels of human performance; and
- Predicting system and component failures more accurately.

Researchers identify the best approaches to enable improved and cost-effective verification and validation of complex, safety-related systems, thereby enabling integration of new technologies and procedures that maximize safety and efficiency both on the ground and in the air.

A key initiative within the project involves development of advanced software to anticipate potential safety issues and identify their resolution. Part of this approach entails "data mining": using automated computer techniques to analyze patterns within accident and other reported air-travel data to identify the previously unknown reasons for mishaps. Another, related effort investigates the effectiveness of algorithms to pinpoint the potential root causes of risks and predict possible future system failures.

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To develop a more comprehensive understanding of human involvement in aviation safety, the project also conducts extensive studies of how human beings interact with automated flight deck and air traffic control systems. These studies contribute toward development of methods, design tools and technologies that promote safe NextGen operations.

Research on prognostic tools and technologies aims to predict the remaining useful life of hardware and software systems. Knowledge of impending failures allows personnel to take appropriate steps to ensure continued flight safety.

Vehicle Systems Safety Technologies Project

Project research focuses on the study of safety improvements related to vehicle systems, including guidance-and-control capabilities and appropriate crew response that can detect, avoid, prevent and recover from hazards experienced in flight or within the vehicle itself.

Project studies aim to more efficiently and effectively assess aircraft health at the material, component and subsystem level by developing advanced health-management tools and systems. In this way, operators will be able to predict, manage and compensate for the aging of airframes, propulsion, and avionics subsystems.

Researchers also investigate loss-of-control events that may occur because of unintended entry into unusual flight conditions, response to on-board failures, and/or environmental disturbances. NASA is developing, assessing and validating methods for avoiding, detecting and successfully resolving such situations. This effort includes development of future flight deck design tools and concepts to promote effective human-automation interaction and error recovery.

We're Working on...

Predictive software that anticipates safety problems before they ever occur

Design concepts for built-in sensor systems to continuously monitor airplane health

Ways to avoid engine icing and sudden loss of thrust

Next-generation flight-deck designs to help pilots interact more effectively with aircraft automation

For more information about the Aviation Safety Program and NASA aeronautics research, visit www.aeronautics.nasa.gov/programs_avsafe.htm.